

**REMARKS**

Claims 1-20 are currently pending. By this response, claims 1 and 15 have been amended, no claims have been cancelled, and no claims have been added. Support for these amendments, and for any new claims, may be found throughout the specification. Cancellation or amendment of any claim is not to be considered a dedication to the public of any subject matter.

Thus, claims 1-20 are currently under consideration.

**CLAIM OBJECTIONS**

Claims 1-18 were objected to because, according to the Office Action of January 18, 2008, there is insufficient antecedent basis for “the current signal” in the phrase “demodulating the current signal”, which occurs in step (iv).

Applicants respectfully disagree.

Step (i) of claim 1 recites “generating a current signal”, which provides the antecedent basis for all other references to “the current signal” in claims 1-18, including the phrase “demodulating the current signal” to which the Office Action objected.

The Applicants therefore respectfully request withdrawal of the objection to claims 1-18 and allowance of the pending claims.

**CLAIM REJECTIONS UNDER U.S.C. § 103**

**A. Claims 1-6, 9-14, and 16**

Claims 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, and 16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over US 6,339,722 to Heethaar et al (“Heethaar”) in view of B.J. Thomas et al. (“Bioimpedance Spectrometer in the Determination of Body Water Compartments: Accuracy and Clinical Significance,” Appl. Radiation. Isotopes. Vol. 49, No. 5/6 pp. 447-455, 1998 (“Thomas article”).

The Applicants respectfully disagree.

Neither Heethaar nor the Thomas article teach or suggest all of the features of Applicants' claims 1-6, 9-14, and 16. In particular, Neither Heethaar nor the Thomas article suggest step (vii) of method claim 1, "repeating steps (v) to (vii) to *obtain a time varying plot of the zero frequency impedance*" or step (ix), "calculating measure of cardiac function in the patient from said time varying plot of the zero frequency impedance". All of claims 2-6, 9-14 and 16 depend from claim 1 and therefore include this limitation.

The use of the time varying plot of the zero frequency impedance to measure cardiac function is a key improvement over prior art systems such as described in the Thomas article and Heethaar. These references use only the impedance over time (e.g.,  $Z$ ), and do not use the *time-varying zero frequency impedance over time* (i.e.,  $dZ_0/dt$ ), as described by the instant claims and specification. Using the time-varying impedance over time allows an increase in reliability and signal-to-noise over merely using the impedance over time when compared to the approximation based on the simply  $Z$ .

The Applicant's FIG. 2 illustrates the difference between the pending claims and the combination of Heethaar and the Thomas article. Step (vii) of claim 1 is represented by the arrow from box 8 to box 1, showing that the determination of  $Z_0$  over time (i.e., over a full cardiac cycle in this example), so that the time varying plot of the zero frequency can be determined and used to calculate a measure of cardiac function (i.e.,  $SV$ ).

Neither the Thomas article nor Heethaar suggests this step. Instead, Heethaar shows a method of approximating using  $Z_0$  at a single time based on multiple frequencies. See, e.g., Heethaar col. 3:37-41. Thomas cannot cure the deficiency. While the Thomas article does teach using multiple frequencies to determine impedance values, including the zero frequency impedance ( $Z_0$ ). The Thomas article does not teach or suggest using time-varying impedance over time.

Since neither Heethaar nor the Thomas article, or the combination of Heethaar and the Thomas article teach or suggest all of the features recited in claim 1, claim 1 and any of the claims that depend from claim 1 cannot be obvious in light of the combination of Heethaar and the Thomas article. The Applicants respectfully request allowance of pending claims 1, 2, 3, 4, 5, 6, 9, 10, 11, 12, 13, 14, and 16.

**B. Claims 15**

Claim 15 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Heethaar in view of the Thomas article, and further in view of Bernstein DP “A new stroke volume equation for thoracic electrical bio impedance,” Critical Care Medicine, 1986 14:904-909 (“Bernstein article”).

The Applicants respectfully disagree.

Claim 15 depends from claim 1. As described above, neither Heethaar nor the Thomas article, nor the combination of Heethaar and Thomas suggest all of the features of claim 15, and particularly not obtaining a time varying plot of the zero frequency impedance, and calculating a measure of cardiac function in the patient from the time varying plot of the zero frequency impedance. The Bernstein article cannot cure this deficiency. Instead, the Bernstein article describes a model of thoracic electrical bioimpedance in which the thoracic volume is modeled as a frustum (truncated cone). Bernstein does not suggest measuring the time varying zero frequency impedance. Thus, the Applicants respectfully request allowance of pending claim 15.

**C. Claim 17**

Claim 17 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Heethaar in view of the Thomas article, and further in view of US 5,449,000 to Libke et al. (“Libke”).

The Applicants respectfully disagree.

Claim 17 depends from claim 1. As described above, neither Heethaar nor the Thomas article, nor the combination of Heethaar and Thomas suggest all of the features of claim 17, and particularly not obtaining a time varying plot of the zero frequency impedance, and calculating a measure of cardiac function in the patient from the time varying plot of the zero frequency impedance. Libke cannot cure this deficiency. Libke describes a system for measuring body composition, but does not suggest measuring the time varying zero frequency impedance. Thus, the Applicants respectfully request allowance of pending claim 17.

**D. Claims 7, 8, and 18**

Claims 7, 8, and 18 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Heethaar in view of the Thomas article, and further in view of US 5,309,917 to Wang (“Wang”).

The Applicants respectfully disagree.

Claims 7, 8, and 18 all depend from claim 1. As described above, neither Heethaar nor the Thomas article, nor the combination of Heethaar and Thomas suggest all of the features of claims 7, 8, and 18, and particularly not obtaining a time varying plot of the zero frequency impedance, and calculating a measure of cardiac function in the patient from the time varying plot of the zero frequency impedance. Wang cannot cure this deficiency. Wang describes impedance cardiography, but does not suggest determining a time varying zero frequency impedance. Thus, the Applicants respectfully request allowance of pending claims 7, 8, and 18.

**E. Claim 19**

Claim 19 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Heethaar in view of the Thomas article.

The Applicants respectfully disagree.

Claim 19 (as amended for clarity) recites a “means for determining impedance values at a zero frequency ( $Z_0$ ) and at infinite frequency ( $Z_{inf}$ ) at a plurality of time intervals; and means for calculating measures of cardiac function in said patient from a time varying plot of the zero frequency impedance values.” As described above, neither Heethaar nor the Thomas article, nor the combination of the two, suggest calculating a measure of cardiac function from a time varying plot of the zero frequency impedance value. Thus, claim 19 cannot be obvious in light of the combination of Heethaar and the Thomas article, and the Applicants respectfully request allowance of pending claim 19.

**F. Claim 20**

Claim 20 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Heethaar in view of the Thomas article, and further in view of US 4,890,630 to Kroll et al. (“Kroll”).

The Applicants respectfully disagree.

Claim 20 depends from claim 19. As described above, neither Heethaar nor the Thomas article, suggest all of the features of claim 19 (and therefore claim 20). Furthermore, the addition of Kroll cannot cure this deficiency. Kroll teaches a bio-electric noise cancellation system which does not suggest calculating a measure of cardiac function from a time varying plot of the zero

frequency impedance value. Thus, claim 20 cannot be obvious in light of the combination of Heethaar, the Thomas article, and Kroll, and the Applicants respectfully request allowance of claim 20.

**CONCLUSION**

Applicants respectfully request that the Examiner expedite the prosecution of this patent application to issuance. In the unlikely event that the transmittal form is separated from this document and the Patent Office determines that an extension of time and/or other relief is required, Applicants petition for any required relief including extension of time, and authorize the Commissioner to charge the cost of such petitions and/or other fees due in connection with the filing of this document to **Deposit Account No. 50-4050**, referencing 10189-701.201. However, the Commissioner is not authorized to charge the cost of the issue fee to the Deposit Account.

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